Reprinted from THE JOURNAL OF CRANIOFACIAL SURGERY
Vol. 4 No. 2 April 1993

Use of Porous High-Density Polyethylene Implants in Temporal Contour Reconstruction

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A temporal contour deformity is characterized by a concavity or depression in the soft-tissue contour of the temporal region and is associated with exaggerated relief of the lateral orbital rim and the zygomatic arch. The etiology of the deformity is varied, comprising any condition that results in displacement, atrophy, or absence of the temporalis muscle or the superficial temporal fat pad. We describe reconstruction of this deformity with porous high-density polyethylene implants in 16 consecutive patients, treated between July 1988 and September 1990. The etiology of the deformity and the surgical treatment are described. The results of treatment are assessed on long-term follow-up, ranging from 2 to 4 years postoperatively.

Key Words: Polyethylene implant, temporal contour

The temporal fossa is circumscribed by the zygomatic arch inferiorly, the temporal ridge of the skull superiorly, and the lateral orbital rim anteriorly. Normally, this space is occupied by the temporalis muscle and the superficial temporal fat pad, providing a smooth, convex, soft-tissue contour. Diminution in the volume of the soft tissues within the temporal fossa produces a temporal contour deformity, characterized by an obvious depression in the soft-tissue contour and exaggerated relief of the lateral orbital rim and the zygomatic arch.

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The etiology of the deformity is varied, comprising any condition that results in displacement or atrophy of the temporalis muscle or the superficial temporal fat pad. Temporal contour defects have previously been described as a donor site deformity following transfer of the temporalis muscle for coverage or reanimation [1] in patients sustaining ischemic injury and fibrosis of the temporalis muscle following frontotemporal bone flap elevation [2] and in patients with atrophy or prolapse of the superficial temporal fat pad complicating extended coronal flap elevation. (Lacey M, Antonyshyn O, MacGregor JH. Unpublished observations, 1992.)

Reconstruction of the temporal contour deformity aims to obliterate the defect by subcutaneous or submuscular placement of an implant, which augments the deficient temporal soft-tissue volume. The optimal material for this application must be easily carved into a three-dimensional shape, and must maintain its shape, volume, and position in vivo. Although we prefer to use autogenous bone, limited graft availability in these patients, who often require extensive bone grafting for other facial skeletal defects, prompted us to search for a suitable alloplastic material.

Porous high-density polyethylene (PHDPE) (Medpor; Porex Medical, Atlanta, GA) provides the standard of biocompatibility against which other compounds are measured because of its long-term stability and virtual lack of an inflammatory or foreign-body response [3]. Animal histological studies have documented rapid vascular, connective tissue, and bony ingrowth into the implant [4], which provide a stable interface that firmly anchors the implant, particularly when it is placed adjacent to bone. Most importantly, the mechanical properties of PHDPE (high tensile strength, noncompressible, stress- and fatigue-resistant) are such that the volume and shape of an implant are maintained in vivo, with no subsequent degradation or deformation [5].

We describe our experience with the use of PHDPE implants in the reconstruction of temporal contour deformities.

Materials and Methods

Patients

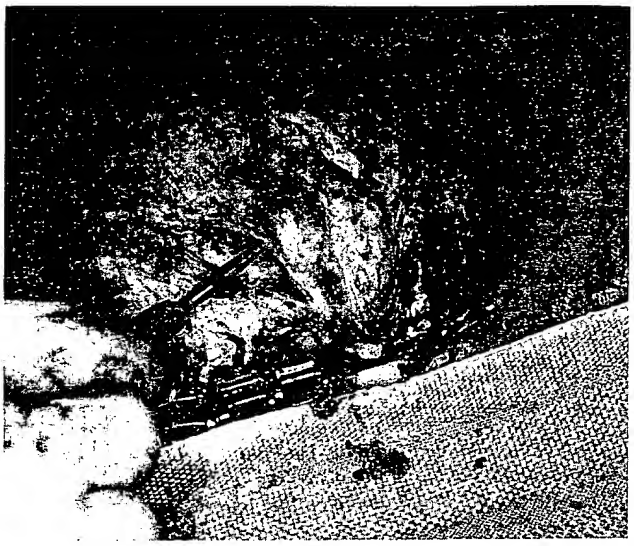
All patients with temporal contour deformities presenting to the Plastic Surgery Clinic at Dalhousie University between July 1988 and September 1990 were included in the study. The clinical series comprises 16 consecutive patients. There were 5 women and 11 men, whose average age was 34 years.

The various causes of contour deformity, as observed in this population, are listed in the Table. In most patients, the deficit in temporal soft-tissue volume occurred as a direct consequence of a planned surgical procedure, and could therefore be anticipated and reconstructed primarily. All patients undergoing temporalis muscle transfer for coverage or reanimation underwent immediate obliteration of the donor site defect with a contoured PHDPE implant. In 5 patients

Etiology of Temporal Contour Deformity

Etiology	*No. Patients*
Donor site deformity following temporalis muscle transfer	4
Excision of superficial temporal fat pad (orbitotemporal neurofibroma)	5
Atrophy/displacement of superficial temporal fat pad complicating extended coronal flap elevation	7

A



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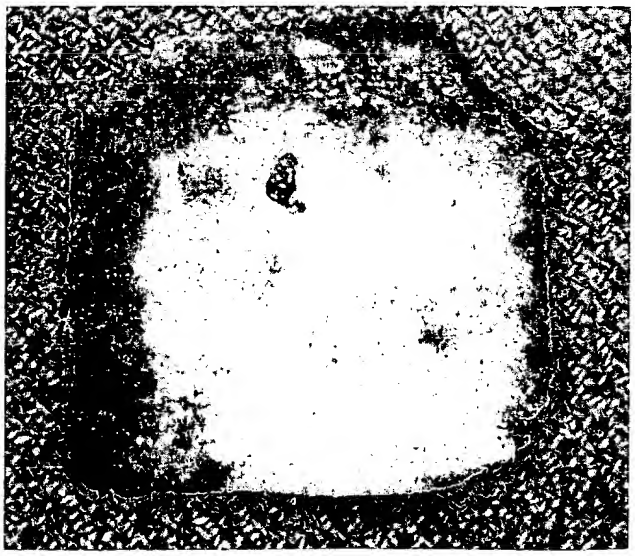


C

Fig 1 Secondary reconstruction of right temporal contour deformity. Intraoperative views following reflection of coronal flap. (A) Depression in the right temporal area due to superficial fat pad atrophy. (B) An incision is made through the temporalis muscle, parallel to muscle fibers. A subperiosteal pocket is dissected deep to the muscle, taking care to maintain muscle attachments to the temporal ridge of the skull. (C) Carved porous high-density polyethylene implant. The volume and shape of the implant must provide thorough adaption to the underlying temporal fossa while correcting the soft-tissue deficit.

with orbital neurofibromas, preoperative magnetic resonance imaging (MRI) revealed tumor infiltrating the superficial temporal fat pad and hypoplasia of the underlying temporalis muscle. Intraoperatively, the volume deficit resulting from radical excision of the neurofibroma was reconstructed immediately with a subtemporal implant.

Seven patients in the series presented with a temporal contour deformity as a complication of extended coronal flap elevation. MRI investigations confirmed that the defect was due to atrophy or prolapse of the superficial temporal fat pad, rather than any change in temporalis muscle bulk.

Surgical Technique

Although causes of the temporal contour deformity are varied, treatment options are dependent on whether there is functioning temporalis muscle present in the fossa. If present, contour augmentation is performed by submuscular placement of the implant.

The approach to the temporal fossa is through a bicoronal flap incision. The dissection is carried down to the deep temporal fascia; the temporalis muscle is split in the direction of its fibers, and the muscle is elevated off the temporal fossa subperiosteally in an area corresponding to the defect. Care should be taken to avoid dissection of the attachment of muscle fibers to the temporal ridge of the skull (Fig 1).

A PHDPE implant of the appropriate size is then carved to the shape required for contour augmentation. Soaking the implant in a warm, sterile solution further facilitates bending of the implant for more accurate adaptation to the underlying calvarial surface. Prior to implantation, the implant is soaked in antibiotic solution.

The implant is inserted into the subperiosteal pocket, deep to the temporalis muscle. It is important to ensure that the deep surface of the implant conforms accurately to the contours of the underlying temporal bone and that its position is stable. The longitudinal incision in the deep temporal fascia is then closed with absorbable suture.

Some variations on this technique are possible. To prevent early migration of the implant, particularly if its position is subcutaneous rather than submuscular, it can be rigidly stabilized with lag-screw fixation to the lateral orbital rim or wall. If only part of the temporalis muscle is transferred, then the posterior portion of the muscle is transposed anteriorly to cover the alloplast and is then sutured to the lateral orbital rim.

If the PHDPE implant must be placed subcutaneously because of a lack of temporalis muscle, careful consideration must be given to precise shaping and feathering of the implant to ensure that its borders are not visible or palpable (Fig 2).

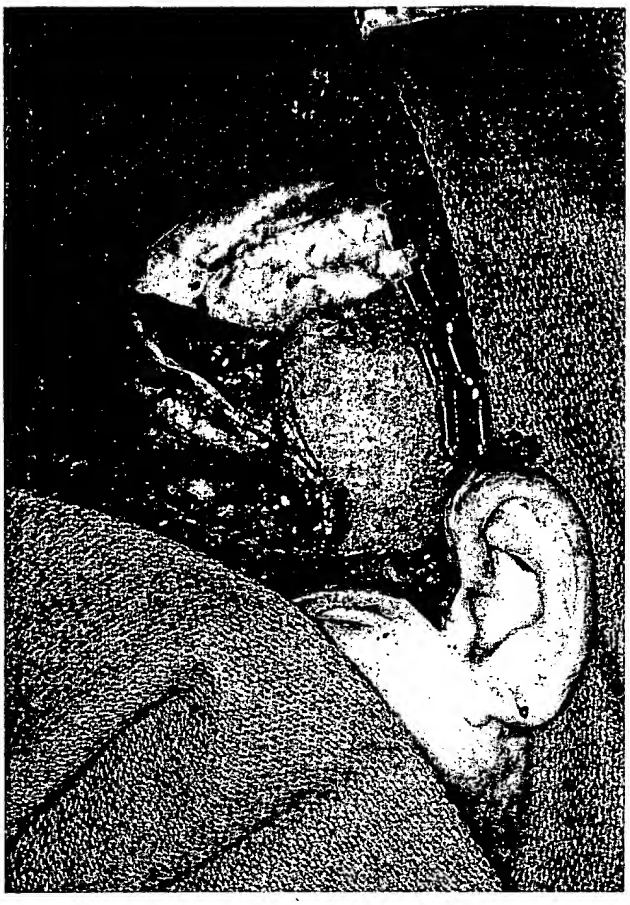


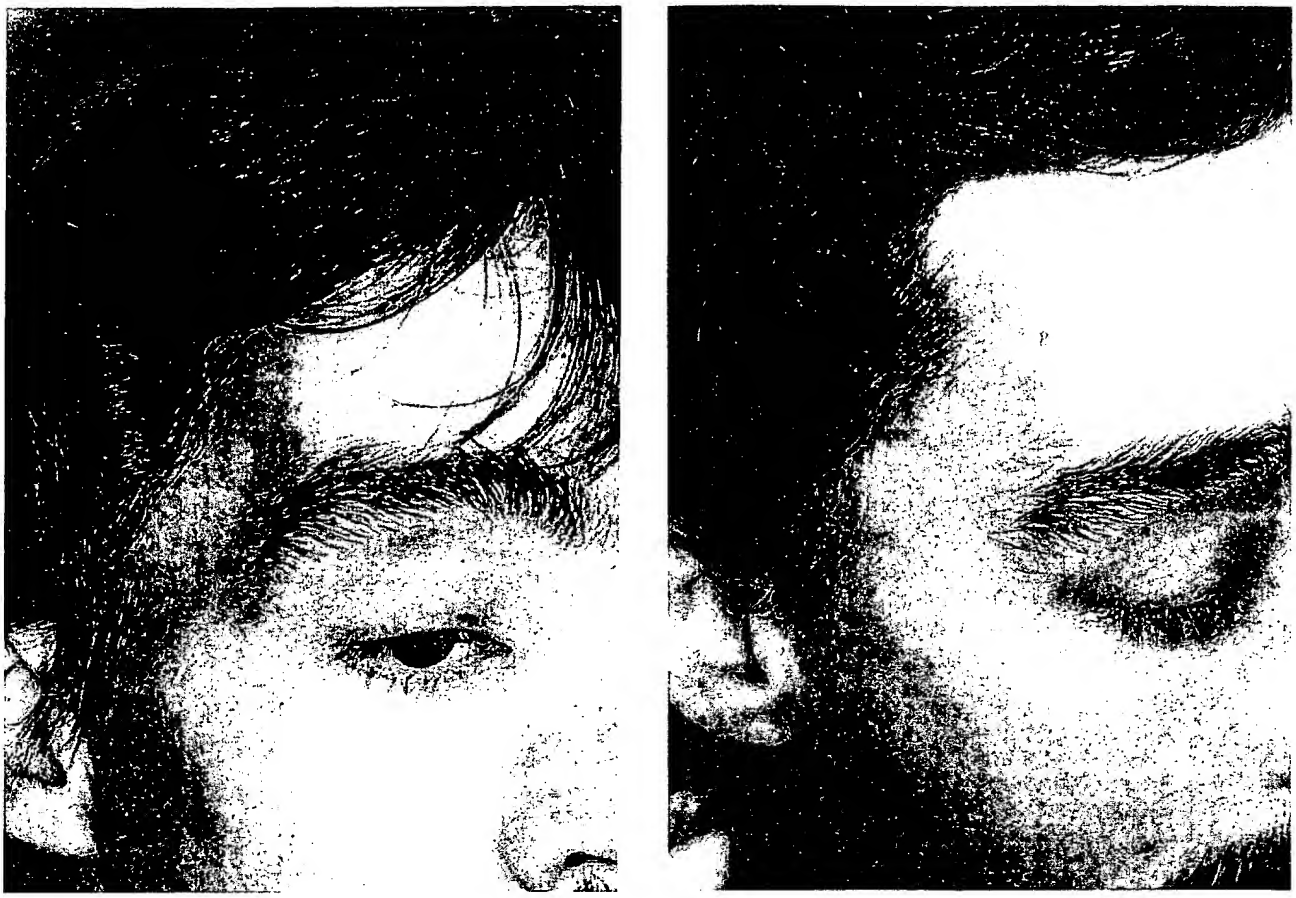
Fig 2 Primary reconstruction of left temporal donor site contour deformity following total temporalis muscle transfer. Because the implant is entirely subcutaneous, precise shaping and peripheral feathering are particularly important. The implant occupies the entire temporal fossa.

Results

Sixteen patients underwent reconstruction of a temporal contour deformity with PHDPE implants. The implant was placed in a submuscular pocket in 12 patients, and in a subcutaneous pocket in the remaining 4 patients.

Submuscular implantation consistently produced the best aesthetic result (Fig 3). The contour deficit was effectively obliterated in all patients, and the implant remained entirely invisible. The overlying temporalis muscle remained active and effectively obscured the margins of the implant, providing a natural contour even during mastication.

Subcutaneous implants, although effective in obliterating the defect, produced a firm, nonyielding, and adynamic temporal contour. The margins of the implant were always palpable, and in 1 patient were clearly visible.



A B

Fig 3 Right temporal contour deformity correction with a submuscular implant. (A) Preoperative view. (B) Result, 3 months' postoperatively.

In this series, stabilization of the implant relied on accurate adaptation of the deep surface of the implant to the calvarial surface and limited dissection of a subperiosteal pocket. Rigid fixation with lag-screws was employed in only 2 patients.

Early migration of an implant was documented in 1 patient, which was attributed to technical error. In this patient, the anterior half of the temporalis muscle was used to resurface a maxillary defect, whereas the posterior half was advanced to cover the temporal implant. The implant was not contained within a limited "pocket" and was not otherwise secured. In the first postoperative week, it prolapsed behind the posterior edge of the muscle and was clearly displaced. There was no implant instability or migration in the remaining 15 patients.

No other complications were observed in this series during a postoperative follow-up period of 2 to 4 years. There were no infections, interference with temporalis muscle function, or pain associated with any of the implants.

Discussion

Use of PHDPE implants as an alternative to autogenous bone grafting has been previously reported in several clinical trials. This alloplastic material has been successfully employed in cranioplasty [6], augmentation [7], and interpositional [8] genioplasty, and in both acute and delayed reconstruction of traumatic orbital cavity defects [9]. Ease of manipulation, rapid fixation, maintenance of structural integrity, and an absence of implant-related complications have been documented in these various clinical applications of PHDPE implantation.

We review the long-term results of temporal contour reconstruction with PHDPE implants in 16 patients.

This technique was found to be a simple and effective method of correcting a soft tissue volume deficit. With the exception of early implant migration in 1 patient, which can be attributed to technical error, the postoperative course was uneventful, and further complications could not be identified on long-term follow-up.

Presented at the 45th Annual Meeting of the Canadian Society of Plastic Surgeons, June 15, 1991, Whistler, British Columbia.

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